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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/583,236
Filing Date: March 06, 2007
Appellant(s): ZHU ET AL.

Eric L. Lane
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed May 18, 2010 appealing from the Office action mailed August 4, 2009.

(1) Real Party in Interest

The examiner has no comment on the statement, or lack of statement, identifying by name the real party in interest in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The following is a list of claims that are rejected and pending in the application: 1-19, 21, 23-25, 27-28, and 30.

(4) Status of Amendments After Final

The examiner has no comment on the appellant's statement of the status of amendments after final rejection contained in the brief.

(5) Summary of Claimed Subject Matter

The examiner has no comment on the summary of claimed subject matter contained in the brief.

(6) Grounds of Rejection to be Reviewed on Appeal

The examiner has no comment on the appellant's statement of the grounds of rejection to be reviewed on appeal. Every ground of rejection set forth in the Office action from which the appeal is taken (as modified by any advisory actions) is being maintained by the examiner except for the grounds of rejection (if any) listed under the

subheading "WITHDRAWN REJECTIONS." New grounds of rejection (if any) are provided under the subheading "NEW GROUNDS OF REJECTION."

(7) Claims Appendix

The examiner has no comment on the copy of the appealed claims contained in the Appendix to the appellant's brief.

(8) Evidence Relied Upon

US 20020173354	Winans et al.	11-2002
US 6856086	Grace et al.	02-2005
US 20030178937	Mishima	09-2003
US 6597111	Silvernail et al.	07-2003
US 20040149984	Tyan et al.	08-2004
US 20030234608	Lee et al.	12-2003

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claims 1, 9, 11, 28, and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Winans et al. (US 2002/0173354) (of record) in view of Grace et al. (US 6856086).

Regarding claim 1, Winans teaches a flexible organic light emitting device comprising a flexible substrate (Fig. 7, 451; Page 12, Paragraph [0119]), a lower electrode layer on the flexible substrate (Fig. 7, 452; Page 12, Paragraph [0117]), an upper electrode layer that is at least semi-transparent (Fig. 7, 454; Page 12, Paragraph [0117]; Page 12, Paragraph [0120]), an organic region between the lower electrode

layer and the upper electrode layer, in which electroluminescence can take place when a voltage is applied between the lower electrode and the upper electrode (Fig. 7, 453; Page 12, Paragraph [0116]), wherein the flexible substrate is comprised of either a metal foil or a plastic film (Page 12, Paragraph [0119]), and wherein when a metal foil is used, the substrate is disposed such that light generated as a result of the electroluminescence directed towards the metal foil is reflected back to the at least semi-transparent upper electrode layer for enhancing light output from the flexible organic light emitting device (Page 12, Paragraph [0119]). Winans fails to teach wherein the substrate comprises both an upper substrate layer comprised of a plastic, a polymer, or a dielectric and a lower metal substrate layer and the lower electrode is formed on the upper substrate layer.

In the same field of endeavor, Grace teaches wherein a flexible composite substrate layer includes both an upper substrate layer of a polymer laminated with a lower reflective metal substrate layer (Fig. 1, 32 & 40; Column 4, lines 15-34; Column 7, lines 3-11) in order to provide a substrate with a moisture and oxygen barrier and structural stability (Column 7, lines 3-11).

Therefore, it would have been obvious to one of ordinary skill in the art to modify the invention of Winans to have the flexible substrate be the flexible substrate of Grace including both an upper substrate layer of a polymer laminated with a lower reflective metal substrate layer in order to provide a substrate with a moisture and oxygen barrier and structural stability, as disclosed by Grace.

Regarding claim 9, Winans further discloses wherein the upper electrode layer is transparent (Page 12, Paragraph [0120]).

Regarding claim 11, Winans further discloses wherein the upper electrode layer is a semitransparent or transparent cathode (Page 12, Paragraph [0120]).

Regarding claim 28, Winans further discloses wherein the organic region comprises a hole transporting layer and an emissive layer or an electron transporting layer (Page 12, Paragraph [0116]).

Regarding claim 30, Winans further discloses wherein the organic region comprises a hole transporting layer, an emissive layer, and an electron transporting layer (Page 12, Paragraph [0116]).

Claims 1, 2-8, 12-13, 15 and 23-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mishima (US 2003/0178937) (of record) in view of Grace et al. (US 6856086).

Regarding claim 1, Mishima teaches a flexible organic light emitting device comprising a flexible substrate (Page 2, Paragraph [0023]), a lower electrode layer on the flexible substrate (Page 3, Paragraph [0034]), an upper electrode layer that is at least semi-transparent (Page 5, Paragraph [0066]), an organic region between the lower electrode layer and the upper electrode layer, in which electroluminescence can take place when a voltage is applied between the lower electrode and the upper electrode (Page 3, Paragraphs [0039]-[0044]), wherein the flexible substrate is comprised of an upper substrate layer of a polymer layer laminated to a lower substrate layer comprised

of a metal foil (Page 2, Paragraphs [0023]-[0024]). Mishima fails to teach wherein the metal foil is reflective such that light generated as a result of the electroluminescence directed towards the metal foil is reflected back to the at least semi-transparent upper electrode for enhancing light output from the flexible organic light emitting device.

In the same field of endeavor, Grace teaches wherein a flexible composite substrate layer includes both an upper substrate layer of a polymer laminated with a lower reflective metal foil substrate layer (Fig. 1, 32 & 40; Column 4, lines 15-34; Column 7, lines 3-11) in order to provide a substrate with a moisture and oxygen barrier and structural stability as well as reflect light back toward the top of the device through the upper substrate layer (Column 7, lines 3-11).

Therefore, it would have been obvious to one of ordinary skill in the art to modify the invention of Winans to have the flexible substrate be the flexible substrate of Grace including both an upper substrate layer of a polymer laminated with a lower reflective metal substrate layer in order to provide a substrate with a moisture and oxygen barrier and structural stability as well as reflect light back toward the top of the device through the upper substrate layer, as disclosed by Grace.

Regarding claim 2, Mishima further discloses wherein at least one of the upper and lower electrodes has an interfacial modified surface for enhancing charge carrier injection (Page 3, Paragraph [0033]).

Regarding claim 3, Mishima further discloses wherein the at least one of the upper or lower electrodes comprises a metal electrode, and wherein the interfacial

surface is modified using inorganic or organic materials or a transparent conductive oxide (Page 3, Paragraph [0033]).

Regarding claim 4, Mishima further discloses wherein the flexible substrate is comprised of a plastic layer laminated to or coated with an aluminum layer, the plastic layer being positioned between the lower electrode and the aluminum layer (Page 2, Paragraph [0023]).

Regarding claim 5, Mishima further discloses wherein the flexible substrate is comprised of a steel foil (Page 2, Paragraph [0023]).

Regarding claim 6, Mishima further discloses wherein the device further comprises an isolation layer between the flexible substrate and the lower electrode layer (Page 2, Paragraph [0023]).

Regarding claim 7, Mishima further discloses wherein the isolation layer is a spin-coated polymeric layer or a dielectric layer (Page 2, Paragraph [0024]).

Regarding claim 8, Mishima further discloses an isolation layer between the steel foil and the lower electrode (Page 2, Paragraph [0023]).

Regarding claim 12, Mishima further discloses wherein the upper electrode layer is a multilayer structure comprising at least one semitransparent or transparent conductive film (Page 5, Paragraph [0067]).

Regarding claim 13, Mishima further discloses wherein the multilayer structure comprises an index-matching layer of a material having an index of refraction index chosen such that the light output is further enhanced, and a charge carrier injection layer (Page 5, Paragraph [0067]; Page 7, Paragraph [0086]). Note that the Examiner

considers the phrase 'chosen such that the light output is further enhanced' to be a claim to a product by process; in a claim to a device it is the claimed structure and not the process which is given patentable weight, in this instance Mishima's disclosed structure of an aluminum layer with an ITO layer formed on it characteristically meets the required structure of a charge injection layer with an index-matching layer.

Regarding claim 15, Mishima further discloses wherein the index-matching layer comprises an inorganic material having a refractive index effective for enhancing light output (Page 7, Paragraph [0086]).

Regarding claim 23, Mishima further discloses wherein the multilayer structure is a cathode and the charge carrier injection layer is an electron injection layer (Page 5, Paragraph [0067]; Page 7, Paragraph [0086]).

Regarding claim 24, Mishima further discloses wherein the electron injection layer comprises a low work function metal (Page 5, Paragraph [0067]; Page 7, Paragraph [0086]).

Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Winans et al. (US 2002/0173354) (of record) and Grace et al. (US 6856086) in view of Silvernail et al. (US 6597111) (of record).

Regarding claim 10, Winans and Grace teach the invention of claim 1, including wherein both the anode and cathode are multi-layer are transparent layers (Page 12, Paragraphs [0117]-[0120]), but fails to teach wherein light from the top-emitting device is emitted through the anode.

In the same field of endeavor, Silvernail teaches wherein an OLED is provided with either the anode or cathode as the top light emitting electrode, thus exemplifying recognized equivalent structures of the OLED in the art (Figs. 1A-1B; Column 1, line 52 to Column 2, line 10).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the top light emitting electrode of Winan and Grace as the anode instead of as the cathode, since the selection of any of these known equivalents would be considered within the level of ordinary skill in the art as evidenced by Silvernail's teaching.

Claims 14 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mishima (US 2003/0178937) (of record) and Grace et al. (US 6856086) in view of Tyan et al. (US 2004/0149984) (of record).

Regarding claim 14, Mishima and Grace teach the invention of claim 13, but fail to teach wherein the index-matching layer comprises an organic material having a refractive index for enhancing light output.

In the same field of endeavor, Tyan teaches a top-emitting OLED with a cathode including an electron injection layer of Li and Ag and an organic index-matching layer of Alq3 as an absorption reduction layer (Page 11, Paragraphs [0109]-[0115]) with a high refractive index in order to improve the luminance of the device (Page 3, Paragraph [0034]).

Therefore, it would have been obvious to one of ordinary skill in the art to modify the invention of Mishima and Grace to have the multi-layer cathode have a high refractive index absorption reduction layer of Alq3 in order to improve the luminance of the device, as disclosed by Tyan.

Regarding claim 25, Mishima and Grace teach the invention of claim 13, including wherein the electron injection layer is a rare earth metal (Mishima Page 5, Paragraph [0067]), but fail to teach wherein the index-matching layer comprises Alq3 or NPB.

In the same field of endeavor, Tyan teaches a top-emitting OLED with a cathode including an electron injection layer of Li and Ag and an organic index-matching layer of Alq3 as an absorption reduction layer (Page 11, Paragraphs [0109]-[0115]) with a high refractive index in order to improve the luminance of the device (Page 3, Paragraph [0034]).

Therefore, it would have been obvious to one of ordinary skill in the art to modify the invention of Mishima and Grace to have the multi-layer cathode have a high refractive index absorption reduction layer of Alq3 in order to improve the luminance of the device, as disclosed by Tyan.

Claims 16-19, and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mishima (US 2003/0178937) (of record) and Grace et al. (US 6856086) in view of Silvernail et al. (US 6597111) (of record).

Regarding claim 16, Mishima and Grace teach the invention of claim 13, including wherein both the anode and cathode are multi-layer structures including charge injection layers and transparent ITO layers (Mishima Page 3, Paragraph [0033]; Page 5, Paragraph [0067]), but fail to teach wherein light from the top-emitting device is emitted through the anode.

In the same field of endeavor, Silvernail teaches wherein an OLED is provided with either the anode or cathode as the top light emitting electrode, thus exemplifying recognized equivalent structures of the OLED in the art (Figs. 1A-1B; Column 1, line 52 to Column 2, line 10).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the top light emitting electrode of Mishima and Grace as the anode instead of as the cathode, since the selection of any of these known equivalents would be considered within the level of ordinary skill in the art as evidenced by Silvernail's teaching.

Regarding claim 17, Mishima further discloses wherein the hole injection layer comprises a high work function metal or a transparent conductive oxide (Page 3, Paragraph [0033]).

Regarding claim 18, Mishima further discloses wherein the high work function metal is gold or silver (Page 3, Paragraph [0033]).

Regarding claim 19, Mishima further discloses wherein the transparent conductive oxide is ITO (Page 3, Paragraph [0033]).

Regarding claim 21, Mishima further discloses wherein the hole injection layer comprises an organic material, an inorganic material, or a combination of inorganic an organic materials that are effective for hole injection (Page 3, Paragraph [0033]).

Claim 27 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mishima (US 2003/0178937) (of record) and Grace et al. (US 6856086) in view of Lee et al. (US 2003/0234608) (of record).

Regarding claim 27, Mishima and Grace teach the invention of claim 23, and wherein the cathode is a two layer structure comprising an electron injection layer of Ca and a second layer of Ag (Mishima Page 5, Paragraph [0067]; Page 6, Paragraph [0070]; Page 3, Paragraph [0033]), but fail to teach wherein the cathode comprises a lithium fluoride layer under the Ca layer.

In the same field of endeavor, Lee teaches wherein the electron injection layer for an OLED is a Ca/LiF laminate with the LiF layer adjacent the organic layers of the organic device in order to provide an electron injection layer that keeps the driving voltage of the device low (Pages 4-5, Paragraphs [0057]-[0058]).

Therefore, it would have been obvious to one of ordinary skill in the art to modify the invention of Mishima and Grace to have the electron injection layer be the Ca/LiF laminate of Lee with the LiF layer closer to the organic layers of the device in order to provide an electron injection layer that keeps the driving voltage of the device low, as disclosed by Lee.

(10) Response to Argument

Appellant's arguments beginning at Page 4, line 18 in regards to the rejection of claims 1, 9, 11, 28, and 30 under 35 U.S.C. § 103(a) over Winans et al. (US 2002/0173354) in view of Grace et al. (US 6856086) have been considered and are not persuasive.

Appellant contends that Winans in view of Grace fail to teach all of the requirements of claim 1. Specifically, Appellant argues that the Winans reference does not teach or suggest reflecting light generated as a result of the electroluminescence for enhancing light output from the flexible organic light emitting device, and that although Winans teaches a reflective metal foil as the flexible substrate, there is no teaching that the reflective metal foil is used in reflecting light from the electroluminescence for enhancing light output from the device, but rather that it is used to make the device more impact resistant. Appellant further argues that Winans disclosure that the reflective metal foil is opaque also precludes it from reflecting light emitted by the device forward to enhance the light output. Finally, Appellant argues that Grace does not supply the elements missing from Winans.

The Examiner respectfully disagrees. The Examiner notes that Winans teaches that the substrate is a reflective metal foil (Paragraph [0119]), that the OLED cell structure is transparent (Paragraph 0120]) and that when it is transparent the substrate may be an opaque foil (Paragraph [0120]); however, a substrate may be both opaque and reflective, contrary to Appellant's argument, since the word opaque describes something which does not transmit light, which is true of a reflective article. Therefore,

the Examiner considers Winans' disclosure of a transparent OLED cell with a reflective foil substrate on one side as meeting the requirement of being disposed such that light generated as a result of electroluminescence that is directed toward the metal layer is reflected back to the semi-transparent upper electrode layer for enhancing light output from the flexible organic light emitting device. Also, the Examiner does not consider Winans' recognition of another benefit of the reflective metal foil, specifically impact resistance, as being contrary to its ability to reflect light incident upon it.

Appellant's arguments beginning at Page 7, line 1 in regards to the rejection of claims 1, 2-8, 12-13, 15, and 23-24 under 35 U.S.C. § 103(a) over Mishima (US 2003/0178937) in view of Grace et al. (US 6856086) have been considered and are not persuasive.

Appellant contends that the Grace reference does not teach or suggest reflective metal coatings used to enhance light output. Appellant further argues that the references do not teach or suggest that light generated as a result of electroluminescence directed towards the metal layer through the upper substrate layer is reflected back to the at least semi-transparent upper electrode layer for enhancing light output from the flexible organic light emitting device. Appellant further argues that Mishima does not teach an interfacial modified surface for enhancing charge carrier injection.

The Examiner respectfully disagrees. Grace does teach a flexible composite substrate including a layer of polymer laminated with a lower reflective metal foil layer

(Fig. 1, 32 & 40; Column 4, lines 15-34; Column 7, lines 3-11—"in embodiments for which the back substrate and the opaque layer is eliminated, the metal protective layer may also function as a reflective layer"). Mishima teaches that light exits its device from the cathode side and that the anode may be colorless and transparent (Paragraph [0036]). In the combination of Mishima and Grace, the polymer upper substrate layer is transmissive and the metal substrate layer is reflective with a transparent electrode located between the electroluminescent layer and the flexible substrate, thereby forming a device wherein light generated as a result of electroluminescence directed towards the metal layer through the upper substrate layer would be reflected back to the at least semi-transparent upper electrode layer and thereby enhance light output from the flexible organic light emitting device. Further, Mishima teaches wherein the anode is a laminate of a metal and metal oxide (Paragraph [0033]), which the Examiner considers as meeting the requirement of an interfacial modified surface, since the metal oxide layer would modify the surface of the metal electrode layer and enhance the charge carrier injection, and also meets the requirements of Appellant's claim 2 (interfacial modified surface) and claim 3 (wherein the interfacial modified surface is a transparent conductive oxide) (see Paragraphs [0033 & 0036]).

Appellant's arguments beginning at Page 8, line 11 in regards to the rejection of claims 1-9, 11-13, 15, 23-24, 28, and 30under 35 U.S.C. § 103(a) in view of Grace et al. (US 6856086) have been considered and are not persuasive.

Appellant contends that Grace is not a proper reference because it relates to a different technology. Specifically, Appellant argues that Grace is not proper because it relates to LCD devices rather than OLEDs.

The Examiner respectfully disagrees. Grace is relied upon by the Examiner to modify the substrate structures of both Winans and Mishima. Grace has relevant teachings to the inventions of Winans and Mishima in that it is drawn to the moisture and oxygen barrier properties of a flexible substrate; both Winans and Mishima are drawn to display devices, like Grace, both Winans and Mishima have flexible substrates and both LCD and OLED devices have a recognized need for moisture and oxygen resistant sealing structures since both devices are degraded by exposure to moisture and oxygen. Therefore, the Examiner considers that the flexible substrate of Grace is analogous to flexible substrates of Winans and Mishima and that one of ordinary skill in the art would have found it obvious to modify the flexible substrates of Winans and Mishima with the flexible substrate teachings of Grace.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

/Anne M Hines/

Examiner, Art Unit 2879

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